IN THE SPECIFICATION

Please replace the second full paragraph, of page 1 with the following amended paragraph:

Background of the Invention

In web and coating manufacturing operations, expensive bulk optic interferometric ~~apparatus~~ apparatuses are used for accurate, on-line measurements of web and coating layer thickness. An ~~Apparatus~~ apparatus , such as shown in United States Patent 5,633,712, by Venkatesh, et al., U.S. Patent 5,659,392, by Marcus, et al. which issued August 19, 1997 and the associated method taught in United States Patent 5,596,409 by Marcus, et al. which issued January 21, 1997 have a high degree of lateral resolution, are light weight, compact, easy to set up, and are robust in high and low temperature environments, in the presence of solvents, high air flow, and various levels of relative humidity. Such ~~apparatus~~ apparatuses self-calibrating or able to remain in calibration for extended periods of time so that the apparatus can be installed on a production machine without the need for re-calibration. Unfortunately, the expensive bulk optics and mechanics required in such devices reduce their usefulness except in high value production applications. In addition, the mechanical nature of the scanning optics of such devices reduce the possible scan rate and service life.

Please replace the third full paragraph, of page 1 with the following amended paragraph:

Therefore, there has been a need for an economical, long lifetime measuring device, which can produce ~~at least as~~ accurate measurements at ~~higher~~ high scan rates

PAGE 3/10 * RCVD AT 9/9/2004 6:09:56 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/3 * DNIS:8729306 * CSID:1 818 225 1569 * DURATION (mm-ss):03-42

that ~~requires~~ require little periodic maintenance and can be packaged with minimal size and mass.

Please replace the first full paragraph, of page 2 with the following amended paragraph:

In the present invention, the disadvantages of the prior art interferometric devices are overcome by eliminating bulk optic and mechanical components, and ~~instead~~ providing an all fiber device. The mechanical components and open optics are eliminated and instead, scanning is accomplished by means of piezo electric fiber stretchers usually configured in tandem to ~~proved~~ provide a rapid, accurate measurement with a relatively large dynamic range. Replaceable sensing probes may be any length and [[to]] do not require length matching to other components of the measuring instrument.

Please replace the fourth full paragraph, of page 4 with the following amended paragraph:

FIG. 3A is a graph of output level vs[[,]] displacement for the autocorrelator of Figure 3 when its probe is pointed at a rear surface mirror; and

Please replace the sixth full paragraph, of page 4 with the following amended paragraph:

Detailed Description of the Preferred Embodiments

Referring to the drawings more particularly by reference numbers, number 10 in figure 1 refers to a prior art Michelson scanning interferometer in which a broadband light source 12 provides white light 13 through a fiber 14 to a polarizer 16. The polarizer 16 and the polarization maintaining fibers 20, 22, 24,and 26 downstream therefrom as well as a polarization maintaining fiber coupler 28 are included to eliminate polarization fading.

PAGE 4/10 * RCVD AT 9/9/2004 6:09:56 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/3 * DNIS:8729306 * CSID:1 818 225 1569 * DURATION (mm-ss):03-42

Please replace the seventh full paragraph, of page 4 with the following amended paragraph:

The polarized white light 30 passes through the fiber 20 and is split into two light beams 32 and 34 by the polarization maintaining fiber coupler 28. The beam 32 is projected out of a non-reflective fiber termination 36, through a focusing lens 38 and onto a mirror device 40. The mirror device 40 may be a corner cube or retro-reflector to assure that the reflected reference beam 44 returns to the termination 36 without much attenuation. The referenced beam 44 is formed by translating the device 40 typically by means of either a motorized linear slide, rocker assembly or a beam deformer 45, whose motion is shown symbolically by the arrow 46. Such techniques have proven to be effective in providing appropriate scan ranges, but have a number of undesirable features when being considered for instrument production. These include: high cost of the launch and collection optics, and specialized motor controllers; low speed scan rates because inertia limits scan rate, and rocker assemblies limit range through angle changes; the requirement for periodic maintenance such as optical alignment and cleaning; the limited lifetimes inherent in mechanical systems with moving parts; and package limitations because compact packages are delicate, so size and mass must be increased for robustness.

Please replace the second full paragraph, of page 5 with the following amended paragraph:

The beams 44 and 56 are combined in the polarization maintaining fiber coupler 28 as an optical signal 60 whose intensity varies with time in reference to the motion of the mirror device 40 where there will be zones of incoherent intensity summation and zones of coherent recombination (of the two beams 44 and 56) . The beam 60 passes through fiber 26 to be projected onto an optical receiver 62 by a non-reflective fiber termination 64. The optical receiver 62 converts the optical intensity levels into electrical signals,

PAGE 5/10 * RCVD AT 9/9/2004 6:09:56 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/3 * DNIS:8729306 * CSID:1 818 225 1569 * DURATION (mm-ss):03-42

which are digitized for subsequent signal processing. Also digitized is the electrical monitor or pick-off signal along line 66 from the translating device 45 by the data acquisition ~~electronics~~ demodulator 68.

Please replace the first full paragraph, of page 6 with the following amended paragraph:

The polarized white light 90 passes through the fiber 80 and is split into two light beams 92 and 104 by the fiber coupler 88. The beam 92 is passed through a piezoelectric fiber stretcher 95 and is reversed in direction by mirror 100 as reference beam 102.

Please replace the second full paragraph, of page 6 with the following amended paragraph:

In ~~piezo-electric~~ piezoelectric fiber stretchers 95, 105, typically a length of fiber is wound around the circumference of a ceramic piezo cylinder element with a sufficient tension that assures that the fiber never goes limp. Using the white light interferometer configuration 70, with available fibers of reasonable length and appropriate piezo ceramic material for the modulators, 10 mm of scan range can be obtained for low frequency scan rates and at 1 mm scans, an order of magnitude faster scan rate can be produced. It is typical that when using 2.3 inch diameter cylinders, each with 40 meters of fiber applied that 10 mm scans at 50 Hz rates and 1 mm scans at 500 Hz may be achieved.

Please replace the fourth full paragraph, of page 6 with the following amended paragraph:

The beams 102 and 116 are combined in the fiber coupler 88 as an interference beam 120 whose intensity varies with time in reference to the stretching of the fibers 82 and 84. To assure that interference between the two beams 102 and 116 occurs, the pathlengths out and back to the fiber coupler 88 must be very close, since any mismatch

PAGE 6/10 * RCVD AT 9/9/2004 6:09:56 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/3 * DNIS:8729306 * CSID:1 818 225 1569 * DURATION (mm-ss):03-42

reduces the dynamic measuring range of the instrument 70.

Please replace the first full paragraph, of page 8 with the following amended paragraph:

The white light 153 passes through the fiber 154, fiber coupler (or three port circulator) 166, fiber 161 and out of a probe 171 for reflection off the sample 172 under test. The reflected beam 174 is re-acquired by the probe 171 is conducted by the fiber coupler 166 and fiber 162 to the second 50/50 single mode coupler 168 where it is split into two light beams 175 and 176. The probe 171 could include a separate optical fiber for re-acquiring the reflected beam 174, in which case, fiber coupler 166 can be eliminated. The beam 175 is passed through a single mode fiber wound piezoelectric fiber stretcher 177 and is reversed in direction by Faraday rotator mirror 180 providing an orthoconjugate reflection causing a 908 polarization rotation as first reference/signal beam 182. The beam 176 is passed through a second piezoelectric fiber stretcher 184 driven opposite from stretcher 177 and is reversed in direction by Faraday rotator mirror 185 where its polarization is also rotated by 90° as second reference/signal beam 186. The second fiber stretcher does not need to be present when a reduced measurement range is all that is required so long as the light beam 176 travels a similar light path distance to that of light beam 175. Passage through the stretchers 177 and 184 can cause birefringence variations so shifting the return beams state of polarization by 90° causes any birefringence variations of the light going through in one direction to be corrected during the reverse passage. The ~~piezo-electric~~ piezoelectric fiber stretchers 177 and 184 are constructed as described for stretchers 95 and 105, with the fibers 163 and 164 forming the light guides thereof being optical path matched.

Please replace the second full paragraph, of page 8 with the following amended paragraph:

The first and second reference/signal beams 182 and 186 are combined into an interference beam 190 by the single mode coupler 168 and conducted by single mode

PAGE 7/10 * RCVD AT 9/9/2004 6:09:56 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/3 * DNIS:8729306 * CSID:1 818 225 1569 * DURATION (mm-ss):03-42

fiber 165 to receiver and processing ~~demodulator~~ electronics 192. The response of the autocorrelator 150 shown as a rectified envelope of the inteferogram from a single autocorrelator scan of a rear surface mirror having a partial reflecting front surface separated by a distance X to the rear reflector as the sample is shown in Figure 3A with the probe through a piezoelectric fiber stretcher 278 and is reversed in direction by Faraday rotator mirror 280 where its state of polarization is rotated 90° as first reference/signal beam 282. The beam 277 is passed through a second piezoelectric fiber stretcher 284 driven opposite from stretcher 278 and is reversed in direction by Faraday rotator mirror 285 where its state of polarization is rotated 90° as second reference/signal beam 286. The ~~piezo-electric~~ piezoelectric fiber stretchers 278 and 284 are constructed as described for stretchers 95 and 105, with the fibers 263 and 264 forming the light guides thereof being optical path matched.

Please replace the second full paragraph, of page 10 with the following amended paragraph:

The autocorrelator 250 shown in Figure 4 uses a coherent ~~optical~~ light source 296 and injects a coherent beam 298 into fiber 299 at a frequency λ_2, that is not common with any of the frequencies centered at λ_1, by means of the WDM 275 positioned between the couplers 256 and 268. It is important that λ_2 be selected such that it can propagate single mode through the same fiber and couplers used for λ_1 and also it be close enough in wavelength to λ_1 (25% is sufficient) so that the couplers and Faraday rotator mirrors (which are typically adjusted to λ_1) are able to (but with small errors) function correctly for this second wavelength. For example, if standard telecommunications single mode fiber is used, selections of λ_1 and λ_2 of 1300 nm and 1550 nm satisfies the criteria. Commercial devices (wide band or dual window couplers, single mode fiber, circulators, Faraday rotator mirrors, and WDM's) are abundant at these two wavelengths. The coherent beam 298 co-propagates with the broadband light inside the scanning interferometer 250. The coherent beam 298 is split by the coupler 268 into coherent beams 300 and 302. The coherent beams 300 and 302 are passed through the stretchers

278 and 284, reflected off the Faraday rotator mirrors 280 and 285, and passed again though the stretchers 278 and 284 for combination on the coupler 268 into coherent fiber modulator sensing beam 306. The beam 306 is conducted along fiber 265 and is separated by the WDM 293 onto a second optical receiver 310 by means of fiber 312 and termination 314.WDMs or other appropriate splitter / filters are used to inject and separate out the returns from the broadband and coherent sources. The detected fringe variations from the coherent light source 296 are used to determine the exact displacement of the scan at all points in the sweep.

PAGE 9/10 * RCVD AT 9/9/2004 6:09:56 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/3 * DNIS:8729306 * CSID:1 818 225 1569 * DURATION (mm-ss):03-42